Mem. Qd Mus. **18**(2): 243–63. [1978]

GASTROINTESTINAL NEMATODES FROM AQUATIC AUSTRALIAN SNAKES

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ABSTRACT

Three new nematodes are described, and another three species are recorded from six species of aquatic snake (Acrochordidae and Colubridae). Four nematodes are from genera which predominantly parasitise vertebrates of other Phyla or Orders, but which inhabit a similar aquatic environment to these snakes.

This paper is the first in a proposed series on the gastrointestinal parasites of Australian snakes. Little work has been done on the nematode parasites of the Australian tropical and subtropical aquatic snakes, most of it being confined to identifications and host records (Johnston and Mawson 1941, 1948), with no indication of intensity or prevalence of infection. This paper is concerned with the gastrointestinal nematodes from 26 Australian aquatic Colubrid and Acrochordid snakes preserved in the Queensland Museum, Brisbane. Representatives from all six Australian species in this group were examined, namely *Acrochordus javanicus, Acrochordus granulatus, Cerberus rhynchops, Myron richardsoni, Fordonia leucobalia* and *Enhydris polylepis*.

The nematodes recovered are as follows:

Subclass ADENOPHOREA
Order ENOPLIDA
Superfamily DIOCTOPHYMATOIDEA

Eustrongylides acrochordi sp. nov.
(Fig. 1, Table 1)

MATERIAL EXAMINED

HOLOTYPE: Queensland Museum G10275, ♀, collected by H. Jones from stomach of *Acrochordus javanicus*, QM J23191, collected by J. Covacevich and C. Tanner near Coen, North Queensland, June 1973.

PARATYPE: QM G10276, ♀, (incomplete), same data as holotype.

DIAGNOSIS

Double row of six apical papillae, marked terminal striations and row of lateral punctations, nerve ring anterior, oesophagus long and voluminous, anus terminal. Vagina opens into the rectum, forming a cloaca. No tail.

DESCRIPTION

Worm long, cylindrical and partly coiled. Very marked striations near both ends, diminishing until scarcely visible near centre of worm. Two lateral rows of very small punctate markings, situated in the striations, proceed posteriorly from anterior end, disappearing within a few mm. Two lateral rows of four evenly spaced small papillae at caudal end, replaced anteriorly by punctate markings as at anterior end, gradually disappearing. Body of fairly uniform thickness, tapering slightly at posterior end but more markedly at anterior end. Mouth elongated dorsoventrally, surrounded by six spined papillae, two laterally and four submedially. Another row of six rounded papillae below these. Another 12 much smaller papillae, two just below each lateral spined papilla, one just anterior to each lateral rounded papilla, and the remaining six at intervals between the two main rows of papillae.

A short straight pharynx leads into a wide undulating oesophagus; this increases slightly in width throughout its length, is without a bulb, and measures 0·2 × the total length of the worm. Nerve ring surrounds oesophagus just behind its origin. No excretory pore seen. A wide rectum, flattened

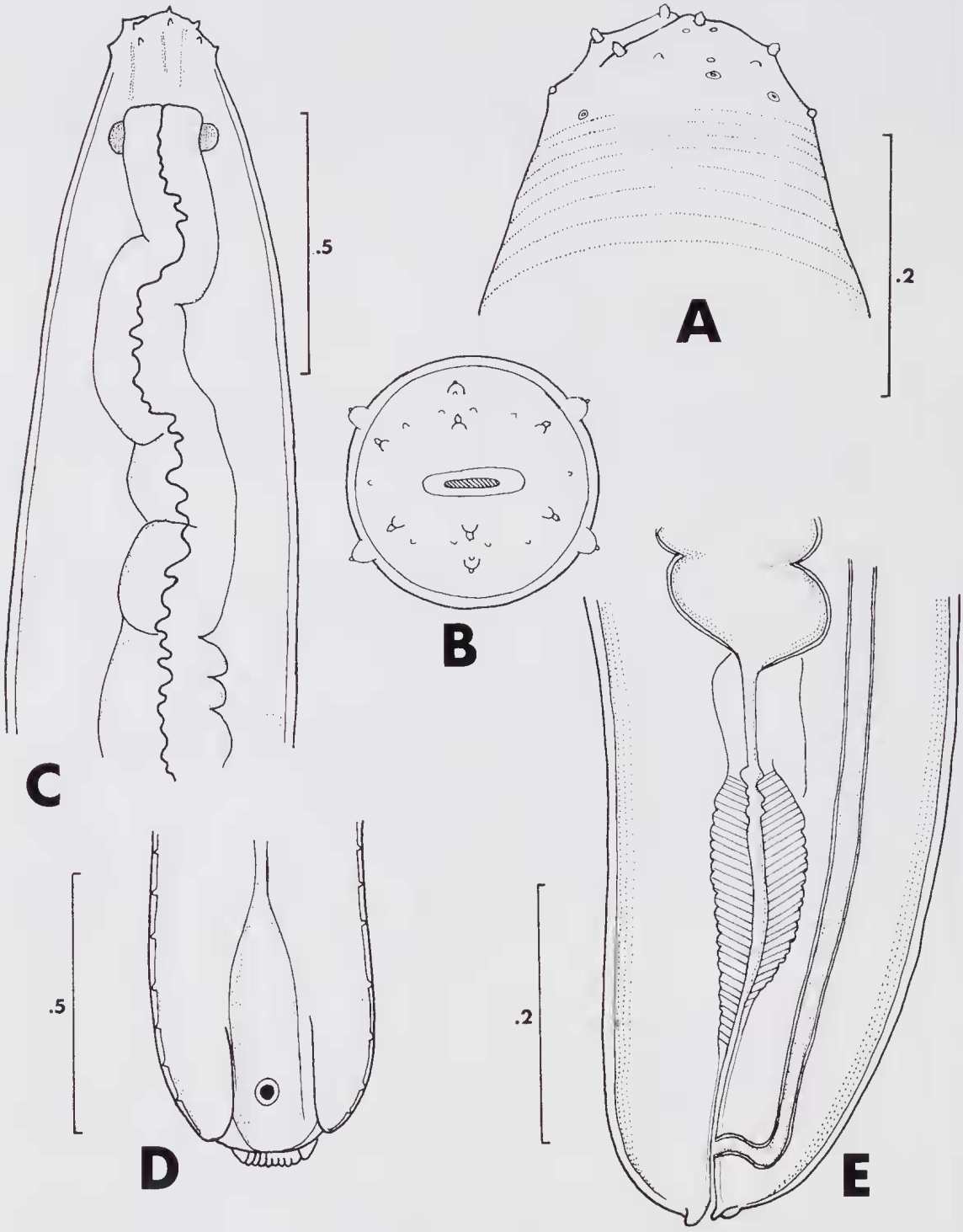

FIG. 1. *Eustrongylides acrochordi* sp. nov. Holotype ♀ G10275. A, anterior end; B, anterior extremity, *en face;* C, Anterior end and oesophagus; D, posterior end, dorsal; E, posterior end, lateral, showing insertion of vagina into rectum.

TABLE 1: BODY MEASUREMENTS (IN MM) OF HOLOTYPE IMMATURE FEMALE *Eustrongylides acrochordi* sp. nov.

Total length	84·50
Width at mid-point	1·03
Width at 2·0 mm from front	0·56
Head width at 1st row of papillae	0·15
Head width at 2nd row of papillae	0·22
Width at beginning of oesophagus	0·28
Oesophagus length	15·90
Oesophagus proportion of length	1/5
Oesophagus width near beginning	0·18
Oesophagus width c. 1/4 along	0·28
Oesophagus width c. 3/4 along	0·42
Pharynx length	0·19
Length of anterior papilla spines	0·01
Nerve ring fr. ant. extremity	0·24
Nerve ring fr. oesoph. beginning	0·03
Caudal papillae distance	0·08
Punctation spacing at anterior end	0·04
Punctation spacing proceeding posteriad	0·13
Anus width	0·10
Rectum length	0·38
Rectum width	0·13
Post. intestine-rectum	1·00
Width of uterus 4 mm fr. tail	0·15
Width of uterus near rectum	0·06
Lumen of uterus	0·04
Uterine wall thickness	0·01
Distance of post. edge of vagina fr. anus	0·08

dorsoventrally, leads into the terminal anus. This is widened laterally and is surrounded dorsally and ventrally by a rugose ridge. There is no tail. Ovary not seen. The vagina passes posteriorly and just before the rounded posterior end of the worm turns sharply medially and enters the rectum. The uterus was not fully developed and contained no eggs.

DISCUSSION

Both the holotype and the paratype (which lacked the anterior end) were lying freely in the stomach among a large number of *Tanqua ophidis*. The worms are characteristic of the genus, but differ from all described species in that the vagina opens into the rectum, forming a cloaca. This feature is sufficient to ascribe them to a new species, even though neither worm is mature. In all other *Eustrongylides* species the vulva opens terminally, very close to the anus. A cloaca has been described from only one other group of adenophorean nematodes, the free-living *Lauratonema* species (Gerlach 1953).

All previous records of *Eustrongylides* species have been from large aquatic birds, from the proventriculus or associated glands, and it is possible that this snake was acting as a paratenic host.

Subclass SECERNENTEA
Order OXYURIDA
Superfamily OXYUROIDEA

Spironoura fordoniae sp. nov.
(Fig. 2, Table 2)

MATERIAL EXAMINED

HOLOTYPE: Queensland Museum G10277, ♂, collected by H. Jones from rectum of *Fordonia leucobalia*, QM J23200, collected by J. Bredl from Edward River, North Queensland, 1973.

ALLOTYPES: QM G10278, 2 ♀♀, (poor condition), same data as holotype.

PARATYPES: QM G10279, 3 ♂♂, 7 ♀♀, same data as holotype; QM G10280, 8 ♂♂, 2 ♀♀, (poor condition), collected by H. Jones from stomach of *F. leucobalia*, QM J23924, collected by J. Bredl from Edward River, North Queensland, 1973.

DIAGNOSIS

Head with three lips surrounded by six papillae. Vestibule present. Pharynx short, oesophagus with hour-glass formation at posterior end, stout equal alate spicules, conspicuous oblique precaudal ventral muscle bands, ten pairs of caudal papillae, one unpaired precloacal papilla, lateral alae from cervical region to near posterior end, vulva just past mid-length.

DESCRIPTION

Worm tapering towards either end. No constriction behind head. Body finely striated. Lateral alae commence in cervical region and run most of the length of body, diminishing in size and finally disappearing in last quarter of body. Tail slender and finely pointed in both sexes. Mouth with three lips, with two papillae at base of each. Short vestibule leading into muscular pharynx, length about 2·5 × width. Oesophagus muscular, long, gradually increasing in diameter to a prebulbar swelling (preceded by a constriction) and a large spherical muscular bulb. Intestine straight and wide lumened. Nerve ring 0·25–0·20 from front of oesophagus. Small but distinct cervical papillae about 0·66 along oesophagus, excretory pore about 0·75 along oesophagus.

MALE: Length rather less than females. Caudal end coiled ventrally. Oblique precaudal ventral muscle bands conspicuous; no ventral sucking disc. No caudal alae. Ten pairs of sessile caudal papillae, arranged as three regularly spaced ventrolateral precloacal papillae, three closely set pairs of paracloacal papillae, and four pairs of caudal papillae of which the most anterior two are

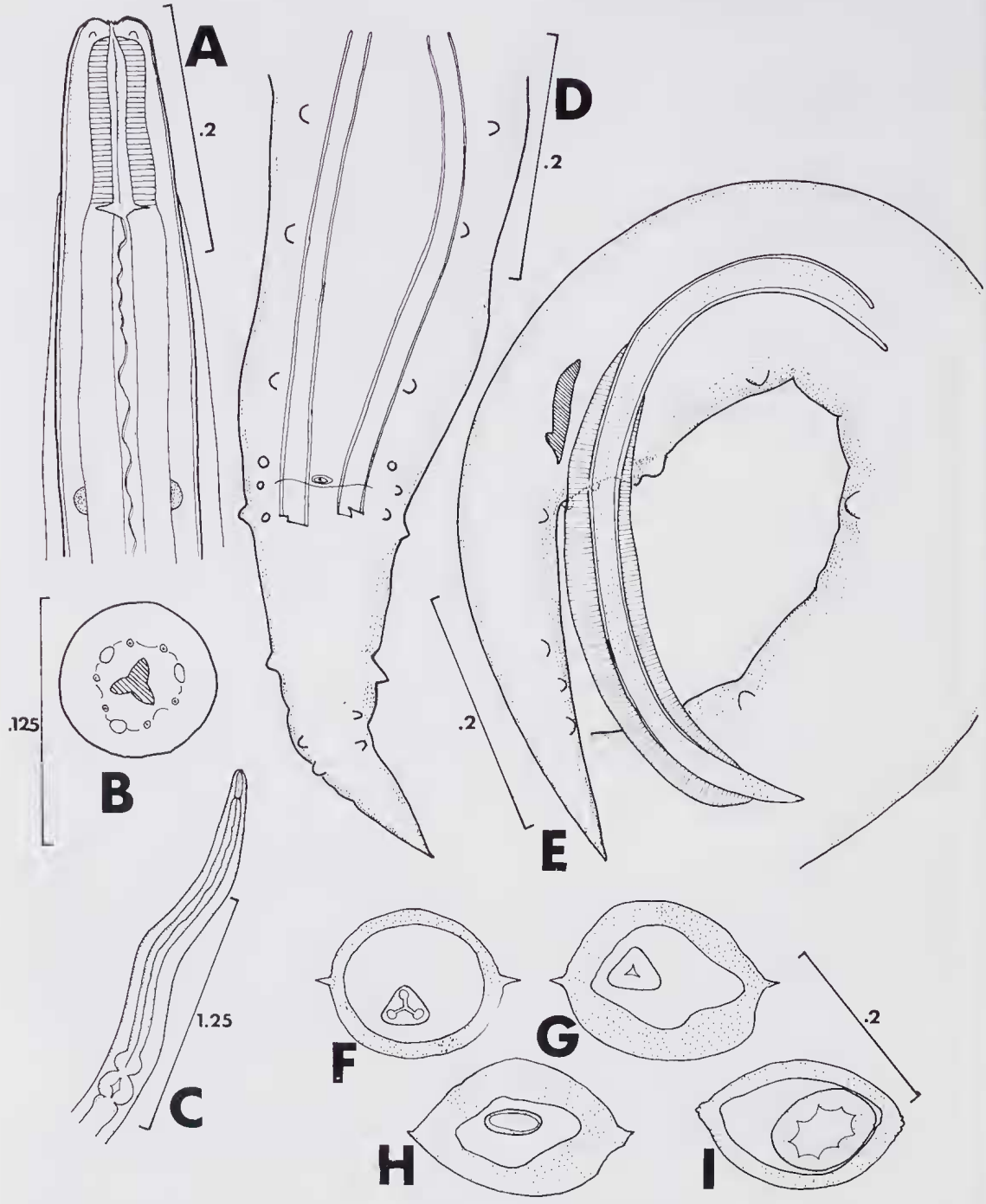

FIG. 2. *Spironoura fordoniae* sp. nov. Holotype ♂ G10277. A, anterior end; B, anterior extremity, *en face;* C, anterior end and oesophagus. D, posterior end, ventral; E, posterior end, lateral; F–I, sections at level of upper oesophagus, lower oesophagus, mid-body and near posterior end, respectively.

TABLE 2: BODY MEASUREMENTS (IN MM) OF *Spironoura fordoniae*, SP. NOV. AND *Camallanides cerberi* SP. NOV.

	Spironoura fordoniae sp. nov.				*Camallanides cerberi* sp. nov.				
	Holotype	Paratypes (Male) (3)	Allotype	Paratypes (Female) (3)	Holotype	Paratypes (male) (3)	Allotype	Paratypes (Female) (10) range	Paratypes (Female) (10) $\bar{x} \pm s$
Length	10.72	9.07 –10.87	12.67	9.3 –13.27	10.5	9.0 –10.0	32.0	19.0 – 36.0	25.7 ±5.76
Maximum width	0.227	0.175– 0.245	2.45	1.92 – 2.80	—	—	—	—	—
Nerve ring*	0.38	0.36 – 0.38	0.39	9.38 – 0.40	0.210	0.190– 0.207	0.294	0.224– 0.308	0.269±0.030
Cervical papilla*	1.01	1.01 – 1.15	1.12	1.12 – 1.36	0.40	—	—	—	—
Excretory pore*	1.49	1.40 – 1.49	1.59	1.40 – 1.75	—	—	0.448	0.380– 0.452	0.410±0.024
Vestibule	0.011	—	0.011	—	—	—	—	—	—
Pharynx length	0.12	0.09 – 0.13	0.13	0.10 – 0.13	—	—	—	—	—
Pharynx width	0.055	0.042– 0.047	0.049	0.043– 0.049	—	—	—	—	—
Oesophagus length	1.78	1.70 – 1.86	1.72	1.70 – 2.1	—	—	—	—	—
Muscular eosophagus length	—	—	—	—	0.344	0.300– 0.329	0.385	0.378– 0.420	0.401±0.14
Glandular oesophagus length	—	—	—	—	0.413	0.392– 0.434	0.587	0.475– 0.636	0.543±0.053
Oesophagus width	0.073**	0.064– 0.067**	0.078	0.070– 0.101	—	—	—	—	—
Muscular oesophagus width	—	—	—	—	0.100	0.092– 0.112	0.160	0.115– 0.154	0.135±0.017
Glandular oesophagus width	—	—	—	—	0.106	0.087– 0.090	0.157	0.104– 0.174	0.131±0.023
First oesoph. bulb width	0.126	0.084– 0.115	0.109	0.098– 0.118	—	—	—	—	—
Second oesoph. bulb width	0.162	0.137– 0.160	0.168	0.137– 0.190	—	—	—	—	—
Ring (base of buccal capsule)	—	—	—	—	0.050	0.046– 0.050	0.087	0.073– 0.092	0.080±0.005
Buccal capsule depth	—	—	—	—	0.095	0.081– 0.092	0.162	0.120– 0.151	0.135±0.014
Buccal capsule width	—	—	—	—	0.095	0.076– 0.090	0.120	0.106– 0.148	0.126±0.013
Tail length	0.37	0.29 – 0.34	0.59	0.51 – 0.63	0.090	0.092– 0.140	0.420	0.392– 0.560	0.447±0.056
Spicule length, left	0.77	0.68 – 0.72	—	—	0.252	0.245– 0.315	—	—	—
Spicule length, right	0.77	0.68 – 0.72	—	—	0.406	0.400– 0.420	—	—	—
Spicule width (with alae)	0.050	0.046– 0.054	—	—	—	—	—	—	—
Gubernaculum	0.112	0.110– 0.112	—	—	—	—	—	—	—
Vulva position†	—	—	55	57 – 63					
Vagina length	—	—	—	—	—	—	2.92	2.72 – 2.96	2.87 ±0.05
Eggs	—	—	122–66μ	108–126×63–66μ	—	—	—	—	—

* from anterior end † % of body length from anterior end. ** excluding bulbs

lateral and the most posterior two ventral. One unpaired precloacal papilla. Spicules equal in length, curved and stout, with wide alae reaching almost to the bluntly pointed tips. Gubernaculum chitinized and elongated, with a pointed posterior end.

FEMALE: Vulva on a slight protrusion, just past mid-length. Vagina directed anteriorly. No caudal papillae. Eggs large, elongated, with thick shells, unembryonated.

DICUSSION

These worms differ from all previously described members of the genus in the possession of lateral alae. As absence of alae is given as part of the generic diagnosis (Yorke and Maplestone 1926; Yamaguti 1961), this must now be amended to read: alae present or absent.

The genus *Spironoura* is confined to the digestive tract of fish, amphibia and reptiles. However of the approximately 27 species which have been described from reptiles (Yamaguti 1961) all but three are from chelonians; only *S. mascula* (Rudolphi 1819) and *S. nitida* (Travassos 1920) have been described from snakes. The only previous Australian record of the genus is *S. elseyae* Johnston and Mawson 1941 from the turtle *Elseya dentata*.

Order ASCARIDIDA
Superfamily ASCARIDOIDEA
Family ANISAKIDAE

Goezia sp.

MATERIAL EXAMINED

Queensland Museum G10292, 2 ♀♀, collected by H. Jones from stomach of *Acrochordus granulatus*, QM J28740, collected by J. Covacevich and P. Filewood, Iron Range, North Queensland, June 1976.

It was not possible to assign these to a species, but they appeared to be the same as specimens recently recovered from Australian sea-snakes and crocodiles, to be described by Sprent (in press). Apart from these, the only previous record of this genus from a reptile has been *G. gavialidis*, (Maplestone 1930), from an Indian Gavial. All other species have been from fish.

Order SPIRURIDA
Suborder CAMALLANINA
Superfamily CAMMALLANOIDEA

Camallanides cerberi sp. nov.
(Fig. 3, Table 2)

MATERIAL EXAMINED

HOLOTYPE: Queensland Museum G10281, ♂, collected by H. Jones from upper oesophagus of *Cerberus rhynchops*, QM J23630, collected by J. Bredl, Edward River, North Queensland, June 1973.

ALLOTYPE: QM G10282, ♀, same data as holotype.

PARATYPES: QM G10283, 3 ♂♂, 11 ♀♀, and 9 incomplete specimens, same data as holotype; QM G10284, 1 ♂, oesophagus of *Enhydris polylepis*, QM J20282, collected by S. Sterling near Cairns, North Queensland, 1970.

DIAGNOSIS

Chitinised buccal valves with 12–14 internal longitudinal ridges. Dorsal and ventral chitinous rods projecting posteriorly from edge of buccal capsule. Four small perioral papillae. Seven or eight pairs of pedunculate precloacal papillae and eight or nine pairs of postcloacal pedunculate papillae in males. Unequal spicules. No gubernaculum. Vulva on a pedunculate prominence; female tail slender and ending in a slight knob. Viviparous.

DESCRIPTION

Fixed worms pale grey in colour, with a black streak running the entire length due to blood or blood products in intestine. Fairly uniform width, anterior end rounded, tail tapering. All specimens were collapsed so diameter could not be measured accurately. Head capsule chitinized, brown. Cuticle finely striated. Mouth elongated dorsoventrally, with four inconspicuous sessile papillae, one beside each corner. Buccal capsule consists of two buccal valves, each of which consists of two chitinous masses separated by a broad longitudinal groove. A smaller chitinous body anterior to each mass, from the median aspect of which is a small projection at the worm's anterior extremity. Twelve to fourteen longitudinal ridges inside each valve, only the central ones of which continue to base of capsule. Chitinous ring at base of buccal capsule. Thin curved chitinous bodies at dorsal and ventral edges of capsule run through ring at base of capsule to anterior end of oesophagus; from exterior aspect of each an irregularly-shaped chitinous bar extends posteriorly.

Oesophagus divided into two portions; anterior muscular portion stout, with pronounced swelling towards posterior end. Posterior glandular portion almost cylindrical in shape, widening slightly towards posterior end, lumen narrow and tortuous. Intestine broad lumened, filled with blood or blood products, running directly to anus. Nerve ring surrounds anterior portion of oesophagus,

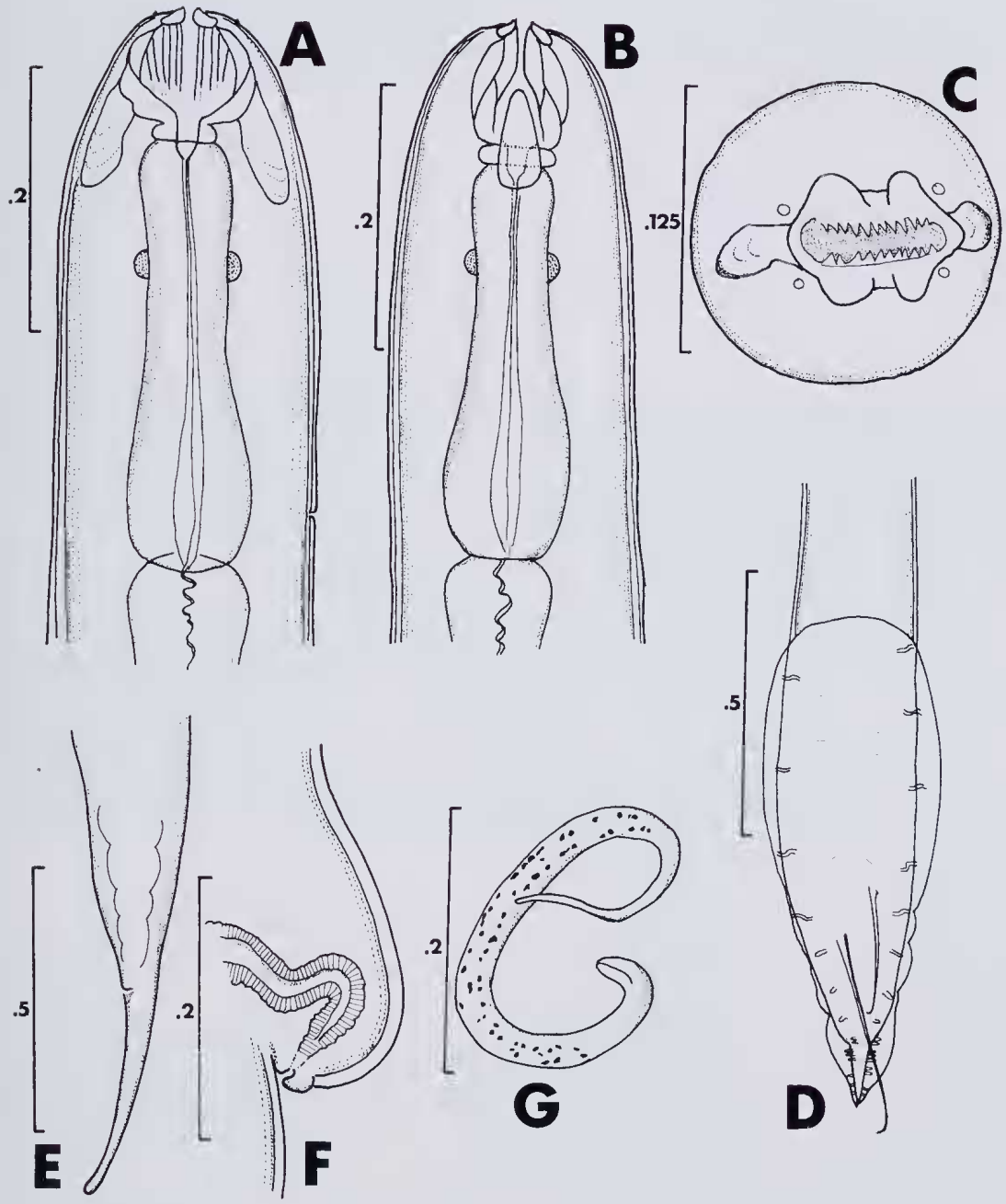

FIG. 3. *Callamanides cerberi* sp. nov. Holotype ♂ G10281, Allotype ♀ G10282. A, anterior end, lateral; B, anterior end, dorsal; C, *en face;* D, male tail, ventral; E, female tail, lateral; F, vulva, lateral; G, embryo in uterus.

excretory pore near posterior end of muscular oesophagus. Very small bristle-like cervical papilla seen in one female only.

MALE: Less than half length of female. Well developed caudal alae, terminating just before tip of pointed tail. Alae connected anteriorly (not in all specimens), supported by an inconstant number of papillae; six to nine regularly-spaced pedunculate papillae precloacally, and eight or nine smaller irregularly spaced papillae between cloaca and tip of tail. Spicules unequal in size and dissimilar in shape. Larger right spicule (projects from cloaca in all specimens) alate, tapering to fine slightly curved point. Smaller left spicule not alate, but also with a finely curved tip. No gubernaculum.

FEMALE: Mean length 27 mm. Tail long and tapering, terminating in an almost club-shaped knob, with or without a conical tip. Vulva situated just anterior to midpoint of body on rounded pedunculate appendage directly posteriorly. Vulval aperture on dorsal side of appendage, against body of worm, surrounded by two small lips. Muscular vagina runs anteriorly some distance before opening into opposed uterine tubes. All specimens contained many larvae, many of which contained numerous black granules, indicating that they were obtaining nutriment from the females' blood intake.

DISCUSSION

Five species of *Camallanides* are recognised at present, all from the Indian subcontinent: *C. prashadi* Baylis and Daubney 1922, *C. piscatori* Khera 1954, *C. ptyasi* Khera 1954, *C. dhamini* Deshmukh 1968, and *C. hemidenta* Majumdar 1965. *C. prashadi* was recovered from *Naja bungarus* and *Ptyas mucosus*, as well as from *Bungarus fasciatus* by Baylis (1929), and from a frog, *Rana tigrina* by Karve (1930), *C. piscatori* from *Natrix piscator*, *C. ptyasi* and *C. dhamini* from *Ptyas mucosus* and *C. hemidentata* from a freshwater fish, *Channa striatus*. In addition, Gupta (1959) recorded a single unidentified female *Camallanides* from a sea-snake, *Hydrophis cyanocinctus*. All were found in the intestine of their hosts. The five snake species from which these are recorded are not found in Australia, but their distribution overlaps with both that of *Fordonia leucobalia* and *Cerberus rhynchops* in the Indo-Malaysian archipelago. *C. prashadi* has been identified from *C. rhynchops* from Thailand (British Museum, unpublished).

Camallinides cerberi differs from those species described in being larger, in having four instead of six apical papillae, in the absence of a gubernaculum, and in the rounded anterior end. In addition, it differs from *C. prashadi* in the shape of the dorsal and ventral chitinous bodies which do not project forwards as in that species, in the thicker post-directed chitinous rods, and in the wider groove separating the chitinous masses of each valve. Whether or not *C. piscatori* and *C. ptyasi* have dorsal and ventral chitinous bodies seems uncertain (Deshmukh 1968). *C. cerberi* differs from *C. prashadi* and *C. dhamini* in having a relatively shorter and more bulbous vulval appendage; the vulval aperture is on the doral side of this appendage, and not on the ventral side as in *C. prashadi*, *C. ptyasi* and *C. piscatori*. In *C. dhamini* there are 14–16 longitudinal internal buccal ridges, and less inequality in spicule length. These specimens are assigned to a new species on the basis of these various features. Differences in the number and position of the caudal papillae, however, have not been taken into account; they have been used to some extent in differentiating species in this genus but, at least in *C. cerberi*, they are variable. *C. piscatori* and *C. dhamini* were described from one male, *C. ptyasi*, *C. hemidenta*, and the redescription of *C. prashadi* (by Agrawal 1967) were from two males. In view of this, and the fact that three of these *(C. prashadi*, *C. ptyasi* and *C. dhamini)* have been described from the same host, *Ptyas mucosus*, it seems desirable that a greater number of specimens be examined before differentiation based on these papillae can be relied upon. Further study may question the validity of these species.

Suborder SPIRURINA
Superfamily GNATHOSTOMATOIDEA

Tanqua ophidis Johnston and Mawson 1948

MATERIAL EXAMINED

Queensland Museum G10285, G10286, G10287, G10288 and G10293 from *Acrochordus javanicus* QM J23192, J23718, J23189, J23191 and J23718 respectively (see Table 4); 3 ♂♂ and 1 incomplete specimen in author's collection, stomach of *Enhydris polylepis*, J23215.

Apart from two in the oesophagus and two in the intestine, all specimens were in the stomach, in numbers ranging from seven to 179. Sexes were approximately equal, with a large number of young worms in the two most heavily infected

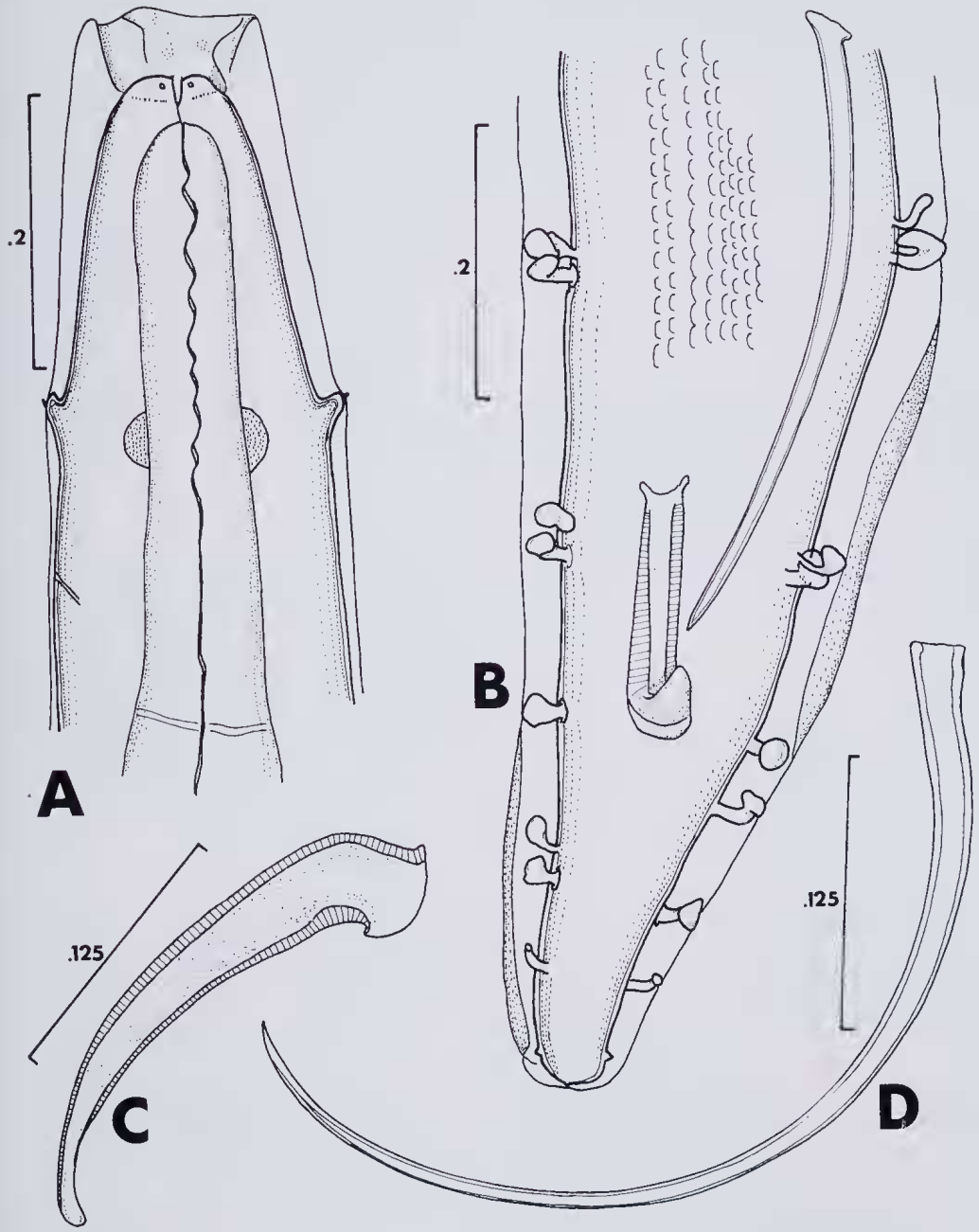

FIG. 4. *Heliconema longissima* (Ortlepp 1922), G10291. A, anterior end, lateral; B, male tail, ventral; C, right spicule; D, left spicule.

snakes; clearly it is a prevalent parasite in this species. It was originally described from a freshwater snake, *Amphiesma mairii*, and from *A. javanicus* (see Johnston and Mawson 1948), and has not been reported since then. *E. polylepis* is therefore a new host record.

Superfamily PHYSALOPTEROIDEA

Heliconema longissima (Ortlepp 1922) (Fig. 4, Table 3)

MATERIAL EXAMINED

Queensland Museum G10291, 37 stomach, 3 oesophagus, 1 rectum *Fordonia leucobalia;* J10262; G10290, 12 stomach and 11 proximal small intestine, *F. leucobalia,* J877; G10289, one from stomach, *F. leucobalia,* J23200.

The characters and measurements of the worms agree in almost every particular with the original description by Ortlepp (1922) and the redescription by Ogden (1969), the only differences being that in these specimens there were never more than nine longitudinal tesselated ridges on the ventral surface of the male caudal region, instead of 12 in Ogden's description, and in the females the vulva was always just posterior to the midlength of the body.

DISCUSSION

In the measurements of this species by Ortlepp (1922), Li (1934) from *Anguilla pekinensis* from China and Ogden (1969), the vulva was always slightly anterior to the midlength of the body. These differences, however, together with the lesser number of tesselated ridges in the male, are not thought sufficient to warrant a new species, and may be host-induced variations.

There has been uncertainty about the hosts of the original material examined by Ortlepp (1922), which had been labelled 'snakes, Australia'. Chabaud and Campana-Rouget (1956) in suggesting that the genus *Ortleppina* erected for the type species by Schultz (1927) was synonymous with *Heliconema,* suggested that the original specimens had been wrongly labelled, and that they had probably come, as had all other known members of the genus, from eels, and this view was supported by Ogden (1969). The finding of these specimens in aquatic snakes now suggests that maybe the original labelling was correct. The present specimens are therefore the first certain records of the genus which were not recovered from eels.

DISCUSSION AND CONCLUSIONS

The nematode species recovered were: *Eustrongylides acrochordi* sp. nov., *Spironoura fordoniae* sp. nov., *Goezia* sp., *Camallanides cerberi* sp. nov., *Tanqua ophidis* Johnston and Mawson 1948 and *Heliconema longissima* (Ortlepp 1922). In 24 of the 26 snakes the stomachs were empty; two *Fordonia leucobalia*

TABLE 3: BODY MEASUREMENTS (IN MM) OF *Heliconema longissima* (ORTLEPP).

	Males (4)	Females (11)	
		range	$\bar{x} \pm s$
Length	17.85 –27.37	28.27 –38.55	32.19 ±3.19
Maximum width	0.192– 0.350	0.402– 0.542	0.499±0.069
Nerve ring*	0.231– 0.315	0.259– 0.350	0.298±0.026
Cervical papilla*	0.231– 0.315	0.245– 0.329	0.290±0.025
Excretory pore*	0.366– 0.413	0.406– 0.546	0.414±0.049
Muscular oesophagus length	0.371– 0.497	0.455– 0.532	0.425±0.028
Glandular oesophagus length	2.47 – 3.62	2.84 – 4.14	3.33 ±0.29
Muscular oesophagus width	0.063– 0.105	0.070– 0.112	0.091±0.006
Glandular oesophagus width	0.119– 0.189	0.140– 0.210	0.178±0.014
Tail length	0.231– 0.350	0.091– 0.203	0.145±0.028
Spicule length, left	0.482– 0.616	—	—
Spicule length, right	0.231– 0.259	—	—
Vulva position†		50–66	56±2

* from anterior end

† % of body length from anterior end

TABLE 4: NUMBERS OF WORMS RECOVERED FROM AUSTRALIAN AQUATIC SNAKES IN THE COLLECTIONS OF THE QUEENSLAND MUSEUM.

Host (Habitat and diet)	Qld. Museum Cat. No.	Locality and Date	*Tanqua*	*Eustrongylides*	*Camallanides*	*Heliconema*	*Spironoura*	*Goezia*
Enhydris polylepis (purely freshwater; various aquatic vertebrates)	J28060	Iron Range, N.Q., 1.vii.1976	—	—	—	—	—	—
	J489	No. data, 1912	—	—	—	—	—	—
	J20282	nr. Cairns, N.Q., 1970	—	—	1	—	—	—
	J22343	Mt. Molloy, May, 1972	—	—	—	—	—	—
	J23215	Mt. Carbine, 12.v.1973	4	—	—	—	—	—
	J23221	Mt. Molloy, 10.v.1973	—	—	—	—	—	—
Acrochordus javanicus (mainly freshwater; almost exclusively fish)	J23189	Edward River, N.Q., 1973	36	—	—	—	—	—
	J23190	Coen, N.Q., 1973	122	—	—	—	—	—
	J23191	Coen, N.Q., 1973	179	2	—	—	—	—
	J23192	Edward River, N.Q., June, 1973	7	—	—	—	—	—
	J23718	Coen, N.Q., June, 1973	30	—	—	—	—	—
	J24917	Coen, N.Q., June, 1973	15	—	—	—	—	—
	J28911	O'Shanassy Riv, N.W.Q., Oct., 1976	14	—	—	—	—	—
	J28912	O'Shanassy Riv, N.W.Q, Oct., 1976	9	—	—	—	—	—
Myron richardsoni	J16653	Normanton, N.Q., 1969	—	—	—	—	—	—
Cererus rhynchope (mainly esturine and mangrove; small crustaceans and fish)	J23630	Edward River, N.Q., June, 1973	—	—	23	—	—	—
	J23717	Edward River, N.Q., June, 1973	—	—	—	—	—	—
	J23948	Edward River, N.Q., June, 1976	—	—	—	—	—	—
		Edward River, N.Q., June, 1976	—	—	—	—	—	—
Fordonia leucobalia (saline waters, to open sea; mainly crustaceans, especially crabs)	J877	? Queensland, 1913	—	—	—	23	—	—
	J1510	New Guinea, 1914	—	—	—	—	—	—
	J10262	Northern Terrty, June, 1959	—	—	—	41	—	—
	J23200	Edward River, N.Q., 1973	—	—	—	1	15	—
	J23924	Edward River, N.Q., 1973	—	—	—	—	10	—
Acrochordus granulatus (saline waters, to open sea; mainly fish and crabs)	J142	Cairns, N.Q., 1912	—	—	—	—	—	—
	J5032	Cairns, N.Q., March, 1930	—	—	—	—	—	—
	J28740	Iron Range, N.Q., June, 1976	—	—	—	—	—	2

(J877 and J10262) contained remains of large crustacea.

The differing habitats of the snakes probably reflect the different composition of their food, and hence their largely different parasites. Data in Table 4 suggest that *T. ophidis* and *E. acrochordi* probably have fresh-water life cycles, *S. fordoniae, Goezia* sp. and *H. longissima* marine life cycles, and *C. cerberi* an estuarine life cycle.

These are the first records of snakes as hosts for parasites in the genera *Eustrongylides* and *Heliconema*. *Goezia* have recently been reported from sea-snakes and crocodiles (Sprent, in press), and the great majority of species in the genus *Spironoura* are found in fish or chelonians. The usual hosts for *Spironoura* spp. (fish and turtles), *Eustrongylides* spp. (aquatic birds) and *Heliconema* spp. (eels) are ones which live in similar environments to these snakes, and with which they may have common food and hence sources of infection. The presence of these parasites in snakes illustrates their physiological opportunism in adapting to phylogenetically different hosts which inhabit the same environment and may be involved in similar food-chains to their more usual hosts. Both *E. acrochordi* and *S. fordoniae* show morphological features not found in other members of these genera (cloaca in one; lateral alae in the other), suggesting that they may be evolving away from the main pattern of forms found in these genera.

ACKNOWLEDGMENTS

I would like to thank Miss. J. Covacevich for her great help in allowing me access to and facilities for the examination of the snakes in the Queensland Museum, and to Professor J. F. A. Sprent for helpful advice and discussion.

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